Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 122 (2014) 477 – 483

Procedia
Social and Behavioral Sciences

2nd World Conference on Design, Arts and Education DAE-2013

Problems that the students face while solving 1st Degree Equations with two Unknown, during their prepare to the High School Entrance Exam (SBS)

Hülya Burhanzade [a], Nilgün Aygör [b]

[a] Yildiz Technical University, Faculty of Art and Science, Department of Mathematics, Davutpasa 34210,Istanbul, Turkey
[b] Yildiz Technical University, Faculty of Art and Science, Department of Mathematics, Davutpasa 34210,Istanbul, Turkey

Abstract

The purpose of the research is identified and manufactures a solution to the problems of the students who attended the High-School Exam (SBS) while solving the 1st Degree Equations with two unknown. Sample of the research is 30 students from 2 different schools in 8th grade of the 2011-2012 academic years in Fahir Ilkel Primary School and Inönü Primary school. The study used both qualitative and quantitative methods. To gather the results of the research, three verbal and three numerical, in total 6 classical methods, questions are given. The data was analyzed by researchers jointly. After analyzing the results we discovered that some of the problems the students face are; calculation errors, students cannot remember the subjects efficiently, lack of information about the related subject, ability to solve test method rather than classical method questions and to establish the relationship between them because of summarize without understanding the conceptual and operational knowledge.

Keywords: High School Entrance Exam-(SBS), 1st Degree Equations, the success of solving equations, mathematics education

1. Introduction

Mathematic is an important tool to solve problems in daily life as well as in science. Therefore math-related behaviors take part in all areas from primary school until the advanced studies. Mathematic teaching is given as preparation from primary education to secondary, from secondary education to the advanced studies. In this research, problems that students who are preparing to pass from primary school to the secondary school, encounter in resolving of two unknowns equations are analyzed, solution methods are searched.

The main aim of the mathematic teaching is to teach a person the information and talents which are required in daily life, to solve problem and also a thinking perspective that takes events in problem resolve shape (Altun 2002). The aim of mathematics education in primary school is to teach four-operation skill that can be used in daily life, to supply the ability to solve some problems from mind and to prepare for the higher class. Mathematic brings correct thinking ability and helps people to solve problems they encounter while they are living their daily lives. Mathematic science's aim is ease the human life, like the other sciences. Mathematics contributes many sciences

* Corresponding Author: Hülya Burhanzade. Tel.: +902123834332; fax: +9002123834314.
E-mail address: ozdag@yildiz.edu.tr.

doi:10.1016/j.sbspro.2014.01.1378

and inventions. Today, the fact of mathematic is the base of the computer that enters all sciences and professions, puts forth the importance of the mathematic (Göker, 1997). Permanent and functional learning of mathematic may be possible by balancing operational and conceptual knowledge (Baki 1998). Also it's seen that in primary schools teachers are focused on the exercises which require operational knowledge. On the other hand, if the lesson is told with problems which require both operational and conceptual knowledge, operational and conceptual information would be balanced.

Algebra has been characterized as the most important "gatekeeper" in mathematics. It is widely accepted that to achieve the goal of "algebra for all", students in elementary school should have experiences that prepare them for the more formal study of algebra in the later grades (National Council of Teachers of Mathematics [NCTM] 2000).Algebra is much more than just solving for x and y ; instead, algebra is a way of thinking. Success in algebra depends on the ability to think in a variety of powerful ways that foster productive algebraic performance. When people think algebraically to solve problems, various habits of thinking come into play, such as doing-undoing, building rules to represent functions, and abstracting from computation (Driscoll1999) (Cai, J., Lew,H.C., Morris, A., Moyer,C.J., Fong ,S., Schmittau, J., 2005).

Algebra is one of the information which a well-developed person should take in our country such as in all other countries. Students start to meet algebra subjects in the second grade of the primary school and this subject constitutes a base for many other subject they are going to meet in their mathematic education in the future for example; problems and functions. According to Ersoy and Erbaş (1998), students' success at algebra issues might affect their mathematic success attitudes in their entire life. Under the reformed vision, instruction should focus on helping students make interpretations between procedural and structural conceptions within algebra. Often the difficulty of students making the cognitive leap from arithmetic to algebra is related to instructional strategies (Kieran, 1992), however, as Kieran noted, "there is a scarcity of research emphasizing the role of the classroom teacher in algebra instruction" (p. 395). A decade or so after Kieran's observation, the research base on teachers' knowledge for teaching algebra is still quite limited (Dorier, in press) (Hallagan, 2004). Although there are many different methods in algebra teaching, the most popular method is the traditional method. Even though algebra is much needed in the life, it is tried to be learned by memorizing by most of the students and also most of the teachers direct students to learn it by memorizing with their methods that they use. Teachers must teach algebra to the students in the way to increase understanding and remembering level to maximum (Kitt and Leitze, 1992) (Yenilmez, K, Teke, M., 2008).

The main aim of the primary and high school mathematics curriculum is to improve algebra and algebraic thinking. Algebra is generally perceived as various symbols, expressions and their representing, and also equations and resolve of the equations (Smith et al, 2000). Equations and finding of its solutions form the base of algebra. Therefore, equations take an important part commonly in mathematic curriculum and specifically in algebra curriculum. Understanding of equation concept and key of the solutions of the equations, prepare the ground for understanding of mathematical terms (Hersovics&Kieran, 1980; MacGregor&Stacey, 1996; Stacey&MacGregor, 2000; Dede, 2003). Filloy and Rojano express that solving equation without applying all steps' requirements, and also solve that equation in a single try by applying a variable isn't a real algebraic improvement. Therefore, a correct algebraic application with an unknown requires solving equation with ready values at the both sides of the equation. According to Filloy and Rojano (1989) solving the equations this way by student is described as the biggest difficulty (Stacey & McGregor, 2000). According Ertekin (2002), equation term is related with the solution of the equation. Before explaining strategies about equation solving, the concept of equality that students have should be determined and the misunderstandings about them should be abolished. Opinions of Payne and Squibb (1990) are in direction of old information which affects resolve of equation are arithmetical operations and for them, before working with algebra subjects, students' arithmetic operation talents must be analyzed.

Students in grade 7th are first introduced to the abstract dimension of algebra as they are solving an equation. Although equations have an important place in mathematics curriculum, they are not really understood by most students. One of the reasons for that could be a belief, held by students, that equations are not perceived as a part of real world. At that point, algebraic word problems have a major role in doing that. Learning how to solve algebraic word problems helps students to make an easy transition from arithmetic to algebra. However, previous studies showed that students in any grade had difficulty to understand algebraic word problems (Dede 2005).

2. Method

2.1 Research Group

This research's samples, in 2011-2012 academic years, are consisted of 60 eighth grade students in total who are from 2 different state schools and from each school 30 students attended. The schools in this sample are 2 different low income schools of Istanbul. In order to achieve the aim of the research, a classical exam is prepared with 6 questions which are possible to solve with first-order equations with two unknowns. Classic exam application's aim is to observe on which subjects do students have lack of knowledge and where do they make mistakes. Because students are used to test system, they don't know how to solve the question, but they can find the answer by starting out from the options. During the preparation on the exam, the gains in the program of mathematic about first degree equations with two unknown and mathematic textbooks are examined firstly. Then in order to specify the talents of the students about solving first-degree equation with two unknown problems, existed questions in the MEB approved textbooks are examined. Three literacy and numeracy, total six questions are chosen among these questions, in order with the opinion of a mathematics educator and a primary school mathematics teacher, this examination is prepared. These specified 6 questions are the literacy and numeracy questions which are possible to meet often in the mathematics textbooks. Examination time is specified as 50 minutes.

2.2. Data Collections Tools and Data Analysis

The prepared exam is applicated to the all students on the spring term of 2011-2012 academic years. After the examination, 4 students from each school are specified by analyzing their solutions. In the student selection, criterions like success level in the exam, mistakes they made, reaching the result with different methods, are considered. Later on, from 2 classes, a total of 6 students attended to the interviews on a voluntary basis. Interviews took approximately 15 minutes and audio recorded. The aim of the interviews is determine the factors which effect their success in resolving the questions and causes of the mistakes they made in the resolve of the questions. Therefore, interviews are done on 2 major situations. During interview, by asking students "What do you think about mathematics lesson?", "What do you think about SBS exam?", "Do you benefit from the textbook which is distributed from MEB, while studying mathematics?", "Which problems do you encounter while you are solving questions?", "Which question was the most difficult for you? Why?", "Do you feel yourself sufficient to solve equations?" the difficulties students encounter while solving such questions are specified. Findings are analyzed in two steps. Firstly, qualitative data analysis is done. By examining the answers of the students; solutions are evaluated as true, false, blank or incomplete. Secondly, with an interview held with students, quantitative data analysis was conducted on the students' opinions.

3. Findings

The findings of this study have been evaluated both qualitative and quantitative. In school-bases the answers of the students are grouped as true, false, blank and incomplete. After converting to the table form, it analyzed qualitative. As it is seen in the table below, the students of Y primary school couldn't answer the questions and almost half of the students in X primary school students answered correctly.

Table1. In school-basis, solution amounts of the answers true, false, blank and incomplete.

Questions	X Primary School				Y Primary School			
	T	F	B	IC	T	F	B	IC
1	8	16	5	1	-	12	13	5
2	12	10	5	3	2	6	10	12
3	9	11	6	4	1	10	12	7
4	12	6	5	7	10	2	8	10
5	20	3	-	7	10	4	5	11
6	10	8	3	9	1	11	13	5

As can be seen in the table below, all students who attend the research have troubles to solve 1st, 3rd and 6th questions, can't handle with decimal numbers, and are not successful in transition from verbal expression to the mathematical expression.

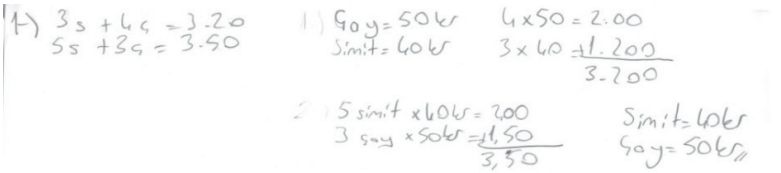
Table 2. True, false, blank and incomplete solutions and percentages

Questions	True		False		Blank		Incomplete	
	f	%	*f*	%	*f*	%	*f*	%
1	8	13	28	47	18	30	6	10
2	14	23	16	27	15	25	15	25
3	10	17	21	35	18	30	11	18
4	22	37	8	13	13	22	17	28
5	30	50	7	12	5	8	18	30
6	11	18	19	32	16	27	14	23

In order to get information from this research, following questions are given to the students. The reliability and validity of the questions is decided according to the opinions and criticisms of the experts. Answers of the students are listed below without any change, by scanning in scanner.

Question 1: In a cafe, one of the tables paid 3,20 TL for 3 bagels and 4 tea, the other paid 3,50 TL for 5 bagels and 3 tea. Find the price in this cafe of one tea and one bagel.

Answer of Student A for 1st question:

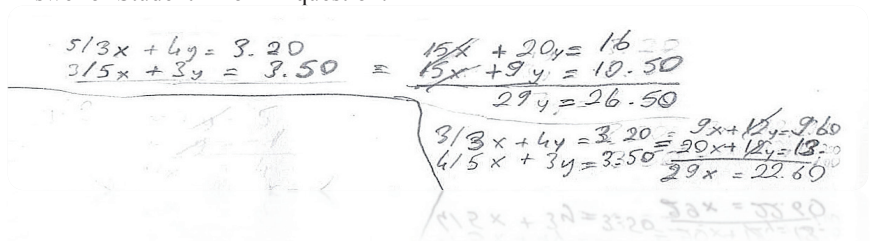


In this question type that generally students have trouble to perceive and have difficulties, Student A realized the required equation system but made the solution in the mind, and then provided the value he found to the equation. Student is insufficient about solving equation systems. He said himself that "Though there's a little time left to the SBS exam, he couldn't remember the subject and didn't take a special help, finds himself sufficient in solving equations and he is bored of preparing to the SBS exam but he likes mathematics lesson". In addition, when the other students' answers are examined, it's specified that similar mistakes are made also by the other students and the students are inclined to find the result with test logic.

Question 2: Find the *x* and *y* values in the equation system given below.

$3x + 4y = 3{,}20$
$5x + 3y = 3{,}50$

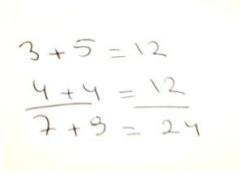
Answer of Student B for 2nd question:



Although Student B knows that he must equate the coefficients to eliminate x values each other, he doesn't know that he must do subtraction process and as he did the subtraction he eliminated *x* values and added *y* values and constant number at the both sides of the equation. Also B, as most of his friends said that "he couldn't remember the subject, he is bored while studying mathematics and doesn't take a special help, he would like the remove of SBS examination, and he solves the equation when an equation is given but has troubles to form an equation." In addition, similar mistakes are specified when the answers of other students are examined.

Question 3: Taylan paid 12 TL for 3 kg of apple and 5kg of pear, Canan paid 12 TL for 4kg of apple and 4 kg of pear. According to that, find the price of 1kg apple and 1kg pear.

Answer of Student C for 3rd question:

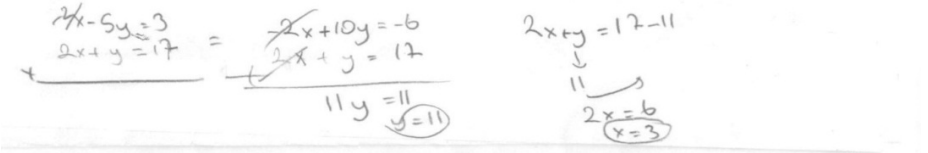


Because the Student C doesn't know that he must set x for apple and y for pear, he just added numbers side to side and couldn't continue the process. It's seen that when the other students' answer-sheets are examined, they also couldn't form the equation or couldn't continue the equation they formed. Student said that "he finds mathematic lesson boring and doesn't understand, can't solve equations, doesn't study to the SBS exam".

Question 4: Find the *x* and *y* values in the equation systems given below

$$x - 5y = 3$$
$$2x + y = 17$$

Answer of Student D for 4th question:



When the answer-sheet of Student D is examined, it's observed that he made concentration failure. Student formed the equation in a correct way but because of the operation error, he couldn't reach to the correct result. Student specified that "he likes mathematics lesson, likes to solve examples, also takes special help, believes that SBS exam is necessary and made a mistake because of lack of concentration".

Question 5: Find x and y values in the equation system given below

$$y = 3x$$
$$x + y = 8$$

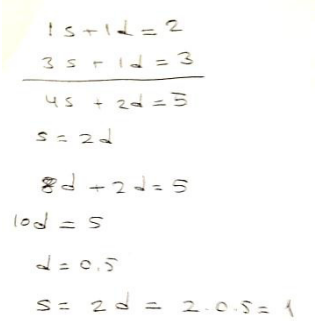
Answer of Student E for 5th question:

Even though most of the students answered correct, Student E couldn't solve this question because of lack of knowledge. Student E said that "He can't remember the subject, has difficulties while studying this lesson and

doesn't take special help, loves mathematics lesson but doesn't like to study and believes that it's necessary to learn mathematics for actual life, not for SBS exam".

Question 6: Mr. Ismail and Mr. Veli will plant onions and tomato into their garden. Mr. Ismail paid 2 TL for 1 kg onion seed and 1 kg. tomato seed, Mr Veli pad 3 TL for 3kg of onion seed and 1 kg of tomato seed. According to that, find the price of onion and tomato seeds.

Answer of Student E for 6th question:



Although student forms the equation correct, he made the solution wrong. When student's answer-sheet is examined, his thoughts about onion as twice of tomato caused him to solve the equation wrong. Student said "When I add the equations side to side, I saw the coefficient of onion is twice of coefficient of tomato. Then I thought as $(s = 2t)$.That caused me to solve the equation wrong". He also said that "He likes mathematics lesson and takes special help for SBS exam".

4. Conclusions and Recommendations

In the result of the research, it's seen that students are not successful in transition from literal expression to the mathematical expression. As it is seen in the Table 2, students got the most success in 5th question. Because of this question consists of more simple mathematical expressions than other questions, students found it easy to solve. Students' success in the resolve of the 1st, 3rd and 6th questions are especially low. From the answers of the related questions, it's seen that students have difficulties to form equations. Most of the students, who attended to the research, left the 1st, 3rd and 6th questions blank or answered wrong. When the answer-sheets of the students who make incomplete or false solutions are examined, it's seen that students can't form first-order equation with two unknowns, can form first-order equation with two unknowns but solved the equation wrong, can form first-order equation with two unknowns but can't continue the process, formed the first-order equation with two unknowns wrong. Even though the second question is consists of the equation system which is solution of the first question, most of the students couldn't realize that. Students found the fifth question easier than the fourth question and solved it easier. The problems student encounter are specified as, calculation errors, can't form the relation between conceptual and operational information because of memorizing without understanding, being inclined to the test logic, misconceptions and lack of knowledge. In the result of this research it is seen that students have difficulties in forming equations. They try to solve equations in the given questions by giving values to the unknowns in test logic.

In the result of this research, it's specified that students try trial and error method in solving questions because they are used to solve test questions, and also form the equation wrong because they can't interpret the question correct. By this reason, it's advised to focus on the question types that students can interpret verbal expressions algebraically, while solving questions in the lessons.

References

Altun, M., (2002), İlköğretim İkinci Kademede Matematik Öğretimi, Erkam Matbaacılık, Bursa.

Baki, A. (1998). Cebirle ilgili İşlem Yanılgılarının Değerlendirilmesi, III. Ulusal Fen Bilimleri Eğitimi Sempozyumu. Karadeniz Teknik Üniversitesi, Trabzon, 23-25 Eylül, 46-49.

Cai, J., Lew, H.C., Morris, A., Moyer, J.C., Fong, S. & Schmittau, J. (2005). The Development of Students' Algebraic Thinking in Earlier Grades: A Cross Cultural Comparative Perspective. Zentralblatt für Didaktik der Mathematik, 37 (1), 5-15.

Dede ,Y.(2004). Öğrencilerin cebirsel sözel problemleri denklem olarak yazarken kullandıkları çözüm stratejilerinin belirlenmesi, Eğitim Bilimleri ve Uygulama,3,(6),175-192

Dede, Y. (2005). I. Dereceden Denklemlerin Yorumlanması: Eğitim Fakültesi 1.Sınıf Öğrencileri Üzerine Bir Çalışma. C.Ü. Sosyal Bilimler Dergisi, 29(2).

Ersoy, Y. ve Erbaş, K. (1998). İlköğretim okullarında cebir öğretimi: öğrenmede güçlükler ve öğrenci başarıları. Cumhuriyetin 75. yılında İlköğretim I. Ulusal Sempozyumu, 27-28 Kasım, Ankara.

Göker, L.(1997). Matematik Tarihi ve Türk-İslam Tarihçilerinin Yeri, Milli Eğitim Basımevi, İstanbul.

Hallagan, J.E. (2004). A Teacher's Model of Students' Algebraic Thinking about Equivalent Expressions. Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education, 3, 1–8.

Payne, J. S. , Squibb, H. R. (1990), Algebra Mal-Rules and Cognitive Accounts of Error, Cognitive Science, 14, 445-481.

Stacey, K., McGregor, M. (2000). Learning the Algebraic Method of Solving Problems, Journal of Mathematical Behavior,18 (2),149-167.

Yenilmez, K, Teke, M.(2008). Yenilenen Matematik Programının Öğrencilerin Cebirsel Düşünme Düzeylerine Etkisi. İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9(15),229–246.